Here are 15+ two-mark questions with answers based on the provided syllabus for "SYNTHESIS OF NANOSTRUCTURE MATERIALS":

Unit-II: SYNTHESIS OF NANOSTRUCTURE MATERIALS (2-Mark Questions)

1. **Q1: Differentiate between top-down and bottom-up approaches in nanomaterial synthesis.**
   - **A1:** Top-down approaches involve breaking down larger materials into nanoscale structures (e.g., lithography, ball milling). Bottom-up approaches involve assembling atoms or molecules into nanostructures (e.g., gas phase condensation, CVD).
2. **Q2: What is the primary principle behind photolithography in nanomaterial synthesis?**
   - **A2:** Photolithography uses light to transfer a geometric pattern from a photomask to a light-sensitive chemical photoresist on the substrate, which then allows for selective etching or deposition to create nanostructures.
3. **Q3: Explain the role of ball milling in synthesizing nanostructured materials.**
   - **A3:** Ball milling is a mechanical top-down method where material is ground into nanoparticles using high-energy collisions between milling media (balls) and the material, leading to plastic deformation and fracturing.
4. **Q4: Briefly describe the process of gas phase condensation for nanomaterial synthesis.**
   - **A4:** Gas phase condensation involves vaporizing a material, typically in a vacuum, and then rapidly cooling the vapor. This supersaturation leads to nucleation and growth of nanoparticles from the gas phase.
5. **Q5: What is vacuum deposition, and name one common type of vacuum deposition technique.**
   - **A5:** Vacuum deposition is a general term for deposition processes conducted in a vacuum environment. It involves vaporizing a source material and depositing it onto a substrate. One common type is Physical Vapor Deposition (PVD).
6. **Q6: Name two specific techniques that fall under Physical Vapor Deposition (PVD).**
   - **A6:** Two specific techniques under PVD are Thermal Evaporation and E-beam Evaporation.
7. **Q7: How does E-beam evaporation differ from thermal evaporation in PVD?**
   - **A7:** In thermal evaporation, the source material is heated resistively to vaporize it. In E-beam evaporation, an electron beam is used to bombard and heat the source material, causing it to vaporize. E-beam evaporation can achieve higher temperatures.
8. **Q8: What is Pulsed Laser Deposition (PLD)?**
   - **A8:** Pulsed Laser Deposition (PLD) is a PVD technique where a high-power pulsed laser beam is focused onto a target material in a vacuum chamber, ablating material to form a plasma plume that deposits as a thin film on a substrate.
9. **Q9: Define Chemical Vapor Deposition (CVD) and state its primary advantage.**
   - **A9:** Chemical Vapor Deposition (CVD) is a process where a solid material is deposited from a vapor phase onto a substrate. Reactants in the gas phase undergo chemical reactions on or near the substrate surface. A primary advantage is the ability to produce high-purity and high-quality films with good conformality.
10. **Q10: Briefly explain the Sol-Gel method for nanomaterial synthesis.**
    - **A10:** The Sol-Gel method involves preparing a colloidal suspension (sol) of precursor materials, which then undergoes gelation to form a network (gel). This gel is subsequently processed (drying, heating) to obtain the desired nanostructured

material.

11. **Q11: What is electrodeposition, and how is it used in nanomaterial synthesis?**
    - **A11:** Electrodeposition is an electrochemical process where a thin film or coating of material is deposited onto a conductive substrate from an electrolytic solution by applying an electric current. It's used to synthesize various nanomaterials, including nanowires and thin films.
12. **Q12: Describe the basic principle of spray pyrolysis for nanomaterial synthesis.**
    - **A12:** Spray pyrolysis involves spraying a precursor solution, typically an aqueous solution containing metal salts, into a heated reactor. The droplets atomize, evaporate, and decompose, leading to the formation of nanoparticles or thin films.
13. **Q13: What is hydrothermal synthesis, and what are its key characteristics?**
    - **A13:** Hydrothermal synthesis is a method of crystallizing materials from hot aqueous solutions at high vapor pressures. It's characterized by relatively low synthesis temperatures compared to high-temperature solid-state reactions and often produces highly crystalline and pure materials.
14. **Q14: Give two examples of how colloidal methods are used for nanomaterial preparation.**
    - **A14:** Two examples include:
        1. **Chemical precipitation:** Forming insoluble nanoparticles from a solution.
        2. **Micelle formation/Emulsion methods:** Using surfactants to create stable nano-sized droplets or structures that act as templates for nanoparticle growth.
15. **Q15: What are quantum dots, and why is their BE growth important in nanomaterial synthesis?**
    - **A15:** Quantum dots are semiconductor nanocrystals that exhibit quantum mechanical properties due to their small size, leading to size-dependent optical and electronic properties. BE (Balling-up/Stranski-Krastanov) growth is important as it's a common method for self-assembled growth of quantum dots in epitaxy, allowing for precise control over their size and distribution.